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The influence of metrical constraints on direct imitation across French varieties

Mariapaola D'Imperio^{1,2}, Caterina Petrone¹ & Charlotte Graux-Czachor¹

¹Aix-Marseille Université, CNRS, LPL UMR 7039, 13100, Aix-en-Provence, France

²Institut Universitaire de France, Paris, France

mariapaola.dimperio@lpl-aix.fr; caterina.petrone@lpl-aix.fr;

charlotte.grauxczachor@gmail.com

ABSTRACT

Recent studies have investigated phonetic and phonological direct dialect imitation in intonation, though no study has yet explored metrical convergence. In this study we therefore test the assumption that speakers of standard French can mimic the metrical properties of a Southern French variety, having a different foot structure, by inserting a schwa either in word-final or in word-medial position. In line with our hypothesis, Standard French speakers were able to produce a greater number of schwas in the Imitation phase, with the result of inserting a weak syllable. Moreover, the effect was stronger word-medially, which we explain through a phonological constraint preventing a left headed foot to appear in word-final position.

Keywords: Prosody, French, foot structure, rhythm, schwa insertion.

1. INTRODUCTION

Speakers align their phonetic representations to those of their interlocutor both in direct and indirect interaction and as a result of exposure to a different variety [10]. This unconscious convergence can be seen as a spontaneous imitation process, manifesting itself both at a segmental and at a prosodic level.

Previous studies have investigated prosodic convergence concerning intonation, both at the phonetic and the phonological level [4, 13, 6, 8]. In the current paper, we focus on prosodic imitation across two French varieties. Cross-variety imitation has been already found in other language varieties. In a recent study on Italian, [6] found that intonation imitation among Southern Italian varieties (Bari and Neapolitan Italian) is the result of both phonetic and phonological convergence. Participants were in fact able to successfully mimic both phonetic and phonological features of the intonation contour, such as tonal alignment detail on one side and the presence or absence of specific edge tones and pitch accents on the other. Moreover, imitation effects were found to be stronger for low frequency words, which is in line with the idea that low frequency items possess a more malleable representation [10].

Recent work on dialect imitation in French varieties [15] has explored the impact of phonetic convergence on understanding an unfamiliar accent by exposing Northern French listeners to words produced by Southern French speakers. The results showed a clear effect of convergence of Northern speakers towards the Southern variety, though imitation did not seem to facilitate word recognition (possibly because the listeners already lived in Southern France and might have hence adapted to this variety). As to studies specifically targeted to prosody convergence in French, [13] showed that specific intonation characteristics, such as the Initial Rise within an Accentual Phrase, can be rapidly imitated across varieties.

Despite the growing body of studies on intonation imitation, no study has yet investigated other types of prosodic convergence, such as metrical convergence. Metrical patterns differ both across languages and, in a more subtle way, across varieties of the same languages. In particular, at the foot level, languages such as English and Italian are trochaic, while a language such as French shows a iambic structure [17, 11].

Within the Prosodic Phonology approach, [17] argues that the prosodic structure of French at the foot level plays an important role in structural descriptions of the rules that affect schwa occurrence. According to Selkirk, in Southern French, if a syllable contains a schwa it links to the previous consonant to form a weak (unstressed) syllable. As a result, a left-headed, bisyllabic foot is created. The immediate consequence is that if a weak syllable is added in word-final position the stressed syllable will be penultimate and not final in the phrase domain (which is the general case for standard French). In French, therefore, Southern varieties can show a left-headed, bisyllabic foot in word-final position due to schwa occurrence, which is usually omitted in Central and Northern varieties [3, 5], e.g. *galette* 'cake' /ga'letə/. Hence, schwa occurrence can lead to the production/perception of an extra syllable (see [3] and section 3 below). Note also that while in Standard French a stressed syllable is always final in the Accentual Phrase [12], in Southern French penultimate stressed syllables are allowed.

In this study we test whether speakers of a central, standard variety of French (the one spoken in Auvergne) are able to rapidly modify the metrical structure of word targets by inserting a schwa (hence inserting a weak syllable) as a result of imitating a Southern French model speaker.

2. METHOD

2.1. Corpus

In order to test our hypotheses, we created a corpus consisting of 20 high-frequency and 20 low-frequency words, with frequency values obtained through the *Lexique* database [14]. In half of each set (10 words each) the schwa could either be produced in word-medial (e.g., *cimiterie* /simə'tjɛr/ 'cemetery') or in word-final position (e.g. *galette* /ga'letə/). Target words were all included in a carrier sentence (e.g. *Je mangerai une **galette** demain midi* 'I will have a cake for lunch tomorrow'). Target word position was controlled in order to avoid preboundary lengthening at Intonation Phrase final position, which might have independently induced schwa insertion [3].

2.2. Participants

We recorded a total of 20 participants, none of which reported speech or hearing disorders, though 18 were retained for the results because of technical problems. Of the 18 participants, 9 were women with an average age of 38.1 years and 9 were men, with a mean age of 37.5 years. All participants were from the Auvergne region. In order to obtain speaker information we asked participants to complete an informed consent and a questionnaire before the experiment.

2.3. Procedure

Stimuli recording was conducted in an anechoic chamber at the *Laboratoire Parole et Langage* (LPL). To obtain Southern French stimuli to be imitated by the participants, we recorded a male speaker from Southern France with a discernible Southern accent. The experiment consisted of two phases, a Baseline and an Imitation Task, which was carried out in a sound recording booth in Clermont-Ferrand, the capital of Auvergne. This allowed us to obtain homogeneity of speaker regional background, as speakers were all from the Auvergne region and without regular exposure to Southern French. Moreover, according to [7] Auvergne French is a dialect that is particularly resistant to schwa insertion.

For the Baseline task, we asked speakers to read the corpus sentences, presented in a slideshow, in the most natural way. These utterances were employed as a reference pronunciation to gauge if convergence had taken place during the Imitation phase. For the Imitation task, we aurally presented the pre-recorded Southern stimuli to our Auvergne participants and instructed them to repeat the sentence they would hear by imitating the speaker. Stimuli were presented via the Perceval software [9] and were randomized both by block and by subject.

We hence created a total of five presentation blocks including the 40 experimental items plus 10 distractors, so that we could test the hypothesis related to the effect of exposure (see 2.4 below). A total of 4209 utterances produced in the Imitation phase were retained for the analysis (2.6% of the data collected had to be rejected because of disfluencies, or technical problems during recording).

2.4. Hypotheses

Our main hypothesis was that Auvergne speakers would be able to produce both word-medial and word-final schwas, as a result of imitating a Southern French speaker. Additionally, we hypothesized that a greater number of schwas would be inserted word-medially than word-finally, because of a prosodic constraint disfavoring trochaic feet at the word right edge in Standard French. By the same token, we hypothesized that word-medial schwas would also be longer than word-final ones (since they should be disfavored in this position).

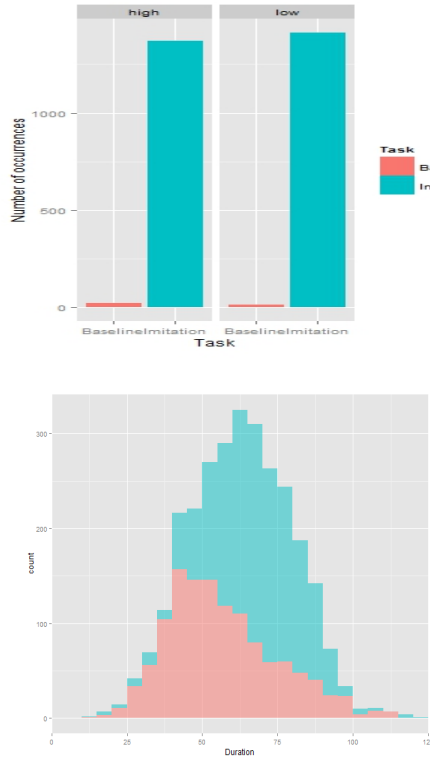
Additionally, we tested whether a greater number of schwas would be produced in later than in earlier repetition blocks within the Imitation phase. In other words, we expected that participants would be more successful when attempting imitation in the fifth and last repetition block rather than in the first block. Finally, given that lexical frequency effects on duration have been reported in several studies [10, 2, 1, *inter alia*] we also tested the significance of this factor.

3. RESULTS

For the analysis of our data, we employed a rather conservative criterion for schwa occurrence, namely that a schwa was actually produced by the speaker only if its duration was at least equal to 30 ms. We adopted this criterion because it appears that a schwa can be perceptually identified in French only when its duration is above 30 ms [3]. In line with our main hypothesis, Figure 1 (upper) shows that, regardless of lexical frequency and position of the schwa in the word, speakers were able to produce a much greater

number of schwas in the Imitation (93.6%) than in the Baseline Task (5.3%).

Figure 1: Total number of schwas by condition (Baseline vs. Imitation, upper) and duration of schwas produced in the Imitation phase by position within the word (final vs. medial, lower).



As we can see in Figure 1 (lower), in line with our secondary hypothesis, a greater number of schwas was produced word-medially than word-finally. Moreover, note also that word-medial schwas were also longer (72.35 ms) than finally produced schwas (42.25 ms) [$\beta = 10.12$, $SE = 2.4$, $t = 4.21$]. Figure 2 shows in more detail schwa duration for low frequency words in both medial and final position. As for average measures, schwa duration was equal to 58.5 ms for high frequency words and 56.1 ms for low frequency words, regardless of position within the word, which is in line with previous findings for schwa duration in Standard French dialects [3].

Table 1: Average duration (ms) by Word Frequency and Word Position for schwas produced in the Imitation phase.

Duration (ms)	High Frequency	Low Frequency	Average value by position
Word-medial	65.45	69.6	67.49
Word-final	58	57.11	57.53
Average value by frequency	62.4	64.06	

Schwas imitated by our participants had a duration of 65.19 ms on average, which is close to the average schwa duration of the model speaker which was equal to 61.95 ms. When position within the word is considered, an average duration of 72.35 ms was found for schwas produced in word-medial position, and of 42.25 ms for word-final schwas, regardless of word frequency. See Table 1 for detailed measures.

Figure 2: Duration of schwas for low frequency items produced in the Imitation phase, by position within the word (final vs. medial).

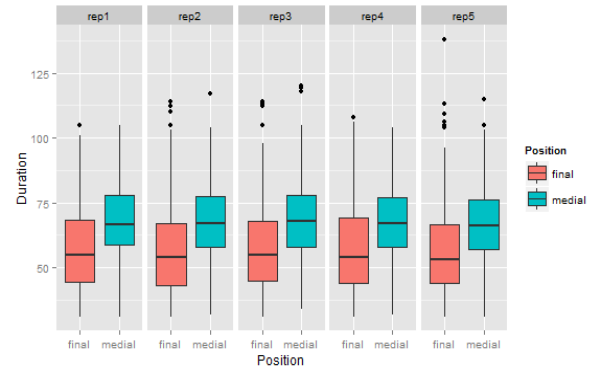
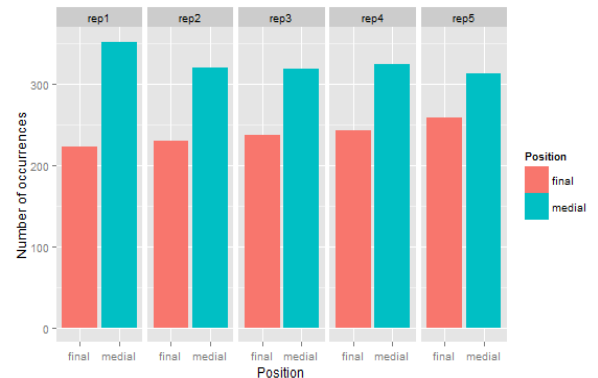


Figure 3: Total number of schwa occurrence by Position (medial vs. final) and Repetition (1 to 5).



To test the significance of the results, we ran a series of mixed-effects models on the Imitation data, with fixed effects being Position within the word (medial vs. final), Word Frequency (high vs. low) and Repetition (1 to 5). This final factor was centered to the first repetition, in order to test whether more successful imitation was produced in the final relative to the first repetition. The random intercepts of the model were Speakers and Words. Task (Baseline vs. Imitation) was not included because of the almost perfect separability of the data as for this factor. Logit models were fitted to the number of schwa occurrences, while linear models were fitted to their duration. The logit model revealed a significant effect of both Position and

Repetition. First, a significantly greater number of schwas were produced in word-medial rather than in word-final position [$z = 5.18$, $SE = 0.86$, $p < 0.001$].

We also found a significant effect of Repetition, across trials [$z = 4.89$, $SE = 0.06$, $p < 0.001$], since more schwas were produced across trials but only for word-final position. On the other hand, no significant effect of Word Frequency nor of Repetition was found on word duration, which was not expected.

5. DISCUSSION

Our main hypothesis was that Standard French speakers from Auvergne would produce a smaller number of schwas in their reference pronunciation (Baseline) than when asked to explicitly imitate utterances produced by a Southern French speaker. Our main hypothesis was supported by the results. We also verified our secondary hypotheses related to Word Position, specifically that (1) a greater number of schwas would be produced in word-medial than in word-final position (2) that newly-occurring schwas would be longer in word-medial position. On the other hand, while a Repetition effect was also found on the number of schwas produced throughout trials, no Word Frequency effect was found.

Although metrical and prosodic structure are both an essential feature of a language variety, hence difficult to modify in L2, our speakers were able to modify metrical patterns of their target words “online”, since the insertion of a schwa created an extra, weak syllable, modifying the original foot structure [17, 5]. Participants were variably successful according to position within the word, in that they produced both a larger number and longer schwas in word-medial position, which is in line with findings reported in [16] for Northern varieties of French. Specifically, [16] reports that in Northern varieties of French, schwa occurrence is more frequent in word-medial position, which the author accounts for partly through the relevance of sociolinguistic factors. In fact, the presence of a word-final schwa appears to be more socially marked, in that it would be associated to Southern speaker identity. On the other hand, word-medial schwas can also quite frequently occur in non-Southern varieties as a result of slow speech rate or segmental context [3].

While this is a valid explanation, we also suggest that metrical constraints proper to French foot structure might prevent speakers from adding a phrase-final, unstressable syllable. We know that French is an edge-based language [12] in which primary stress is located at the right edge of the Accentual Phrase. Adding a final weak syllable, by

inserting a schwa, might be less optimal than inserting a weak syllable word-medially. Hence, both sociolinguistic (indexical) factors and phonological constraints might conspire to give rise to imitated forms preferring word-medial schwa occurrence.

We also found a significant effect of repetition on imitation, since in each subsequent repetition speakers produced a greater number of schwas than in the first block, though this was true only in word-final position. This result is in line with [10] for which amount of exposure predicts convergence: the longer speakers are exposed to a specific production of a lexical item, the easier for them to reproduce it. On the other hand, word frequency did not have any significant effect on either number of schwas produced nor on their duration. This is reminiscent of findings in [3], which did not find an effect of lexical frequency.

In sum, our results are in line with previous studies demonstrating the ability of speakers to imitate structural, prosodic aspects of speech, such as pitch accent location and type [4] as well as more detailed features of the contour [13] or phonetic detail such as tonal alignment and scaling [6]. Moreover, we argue that imitation accuracy and degree are modulated both by constraints imposed by the (prosodic) phonology of the speaker’s dialect as well as by indexical factors.

6. CONCLUSION

Our results suggest that standard French speakers are able to converge in terms of metrical features of lexical items produced by Southern speakers. Specifically, Auvergne speakers were able to insert word-medial and word-final schwas in an Imitation task, therefore producing additional weak syllables that are not present in their baseline pronunciation. Moreover, speakers produced a greater number of schwas (which were also longer) in word-medial than in word-final position.

We account for this effect through both structural and indexical factors that might together disfavour domain-final schwa occurrence in Standard French. While structural constraints require primary accents to occur as close as possible to the right edge of the Accentual Phrase (hence disfavours word-final weak syllables), indexical constraints might prevent speakers to insert word-final schwas because they are strong indicators of Southern French affiliation. Finally, an effect of training was also found through our Repetition factor, suggesting that imitation accuracy can also improve throughout trials.

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